

# A New Species of *Litoria* (Anura: Hylidae) from Eastern Australia

A. M. WHITE, R. W. WHITFORD and M. J. MAHONEY

(Communicated by D. S. HORNING)

WHITE, A. W., WHITFORD, R. W., & MAHONEY, M. J. A new species of *Litoria* (Anura: Hylidae) from eastern Australia. *Proc. Linn. Soc. N.S.W.* 114 (1): 3-10 (1994).

A brown tree frog, *Litoria littlejohni* sp. nov., previously confused with *L. jervisiensis* (Duméril & Bibron 1841) is described from Eastern Australia. The new species is restricted to the plateau and eastern slopes of the Great Dividing Range and adjacent coastal region, extending from 90km north of Sydney N.S.W. to near Buchan in Victoria. It can be distinguished by a combination of the following characteristics: relatively large size, females 52-68mm, males 40-51mm S-V, with the head broader than long (HL/HW = 0.91). The dorsum is smooth with no distinct pattern of mottling, and the axilla, groin and under surface of the thighs are bright orange red. Characteristics of the mating call and karyotype are given.

A. W. White, and R. W. Whitford, School of Biological Sciences (Zoology), University of New South Wales, P.O. Box 1, Kensington, N.S.W., 2033.

M. J. Mahoney, School of Applied Science and Technology, University of Newcastle, N.S.W. 2300. Manuscript received 13 August 1991; accepted for publication 14 October 1992.

KEY WORDS: *Litoria*, Anura.

## INTRODUCTION

White, Whitford and Watson (1980) redescribed the Jervis Bay tree frog (*Litoria jervisiensis* Duméril and Bibron, 1841). This step was necessary as this species had become confused in the literature with a hitherto undescribed species of brown tree frog. The latter species had been referred to by Günther (1858) and was later given the common name of the Heath frog by Moore (1961). The specific identity of both species could not be resolved using the original description of *L. jervisiensis*. More recent field guides (e.g. Barker and Grigg, 1978, Cogger, 1992) have suffered because of this confusion.

As a result of the redescription of *L. jervisiensis* that species is now understood to be a winter-breeding species closely related to frogs of the *L. ewingi* species group. The Heath frog has remained unnamed because of the difficulty in procuring specimens and gathering sufficient biological information about the species. This paper serves to name this species formally and to provide some ecological and reproductive data about that species.

## MATERIALS AND METHODS

Specimens were made available for examination by the following institutions: AMS – Australian Museum, Sydney; NMV – Museum of Victoria, Melbourne; ANWC – Australian National Wildlife Collection, Canberra; CCAE – Canberra College of Advanced Education, Canberra; QM – Queensland Museum, Brisbane; MAMU – Macleay Museum, University of Sydney, Sydney.

Measurements, were recorded to the nearest 0.1mm using dial callipers, following Tyler (1968). External measurements recorded were: snout-vent length (S-V); head length (HL); head width (HW); eye to naris distance (E-N); eye diameter (E); inter-narial span (IN); tympanum diameter (T); and tibial length (TL).

Mating calls were recorded on an Akai model XV reel to reel tape recorder and analysed on a Kay Electronics Sona Graph 6061B sound spectrograph. Chart

recordings were prepared on a Fernbedienung Chart Recorder type F-NB. Ambient temperature was measured with a wet bulb thermometer.

Karyological data were obtained for three specimens of *L. littlejohni* collected from the type locality. Mitotic chromosomes were obtained from intestinal epithelial cells using an air dried technique described by Mahony & Robinson (1980). Nucleolar organiser regions (NORs) were stained following the technique of Goodpasture & Bloom (1976).

*Litoria littlejohni* sp. nov.

Figs. 1-4

*Holotype*: AMS R95802, mature male. Walker's Ridge Road (Joe's Point), Watagan State Forest, approx. 90km N of Sydney, N.S.W. (33°02'10"S, 151°08'00"E). Collected by M. Mahony on 3.ii.1980, from a temporary pool in a roadside ditch.

*Paratypes*: AMS R2406, Lawson, N.S.W. 29.xi.1898; R5006-7, Blackheath, N.S.W. 6.xii.1910; Wilde's Meadow Moss Vale, N.S.W. 11.ii.1913; R8461, Leura, N.S.W. 8.xi.1924; R14643-44, Medlow Bath, N.S.W., 17.x.1955; R19429, Mt Wilson, N.S.W., 30.iv.1963; R69030-33; Bell, N.S.W., 8.iii.1972; R69953-54, Katoomba, N.S.W. 31.i.1978. R95803-806, Walker's Ridge Road, Watagan State Forest, N.S.W., 3.ii.1980; NMV D26658-61, Royal National Park, N.S.W., May 1960; D26662, Royal National Park, N.S.W., 21.viii.1962; D26680-82, Clyde Mtn, N.S.W., 14.5km SE Braidwood, N.S.W., 13.i.1965; D26683, 16km SE Braidwood, N.S.W., 12.ii.1968; D26684-5, 16km E. Braidwood, N.S.W., 12.ii.1968; D26688, 6km SW Robertson, N.S.W., 22.x.1969, Tianjara Falls, N.S.W., 23.x.1969; D32638, 20km SW Tomerong, N.S.W., 20.x.1969; D32639, 6km SW Robertson, N.S.W., 22.x.1969; D43666, Brown Mtn, Rutherford, N.S.W., 23.xiii.1970. CCAE 62-3, 3.3km SW Wadbilliga Mtn, N.S.W., March 1974; 270, Mt Dromedary, N.S.W., Sept. 1974; 297, Wadbilliga, N.S.W., March 1974; 288, Barren Grounds, N.S.W., April, 1974; 355-357, Mt Dromedary, N.S.W., 20.xi.1974; 493-495, Brogo River, N.S.W., Jan 1976; 497-99, Wadbilliga, N.S.W., Jan 1976. MAMU B0187, Randwick, N.S.W., 6.iii.1886. NMV D26663, Club Terrace Bypass, Vic., Dec 1962; D26664-79, 12.5 miles W Cann River, Vic., 24.viii.1963; D26686-87, The Gap, Bonang Hwy, Vic., 31.v.1968; D26690, 11.2km W Cann River, Vic., 20.x.1969; D32641, 11km W Cann River, Vic., 20.x.1969; D49309, 10km NW Buchan, Vic., 17.viii.1977; D50022-24, Mt Elizabeth, Vic., 20.ix.1977.

*Measurement of holotype* (in mm): S-V 46.0, TL 26.8, HL 14.7, HW 16.4, E-N 4.3, IN 4.2, E 4.8, T 2.4.

*Description of holotype*: Adult male (S-V 46.0mm), head broader than long (HL/HW 0.90). Head length approximately one-third body length (HL/S-V 0.32). Snout round in dorsal and lateral aspects, projects slightly (Fig. 2). Snout not prominent, distances from eye to naris slightly more than internarial span (E-N/IN 0.98). Nares more superior than lateral. Eyes prominent and large (E/T 2.0). Canthus rostralis distinct, slightly concave when viewed from above. Prominent supratympanic fold terminating above axilla. Submandibular gland absent. Vomerine teeth small, located between choanae (see Moore 1961, Fig. 55).

Fingers long with prominent discs wider than digits. Trace of webbing between fingers 3 and 4. Fingers, in order of length, 3 > 4 > 2 > 1 with well advanced subarticular tubercles (Fig. 3a). Posteroventral ridge along forearm.

Hind limbs long and slender (TL/S-V 0.58). Webbing between toes not extensive, the disc and one phalange of the fourth toe are free (Fig. 3b). Toes 2 and 3 with prominent discs; disc on other toes not extending beyond lateral extremities of digit. Toes, in

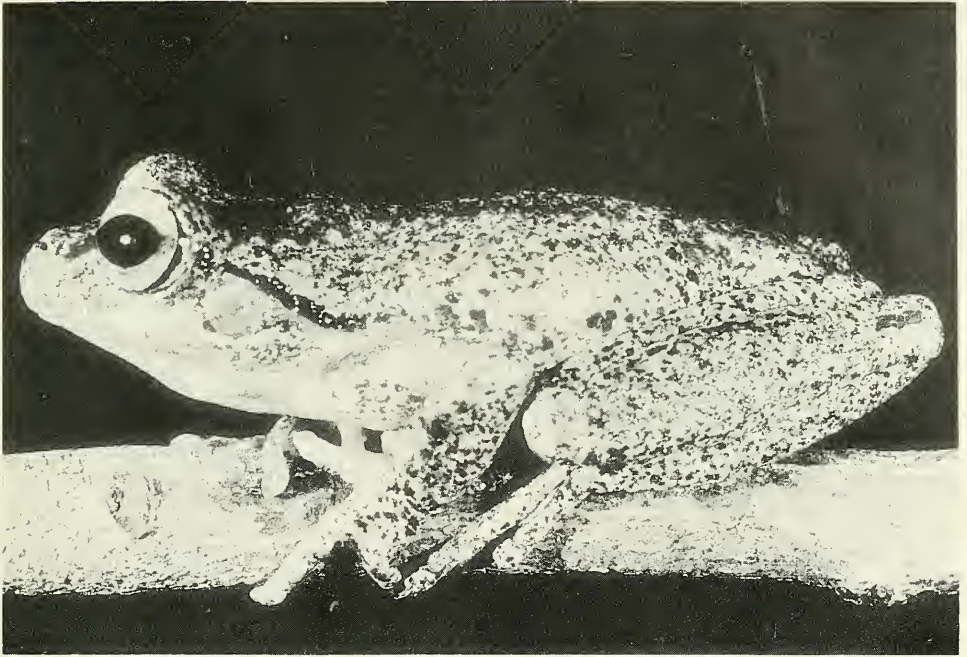


Fig. 1. *Litoria littlejohni* sp. nov., Darkes Forest, N.S.W. in life. (Photograph: R. W. Whitford).



Fig. 2. Lateral view of the head of *Litoria littlejohni* (AMS R95802).



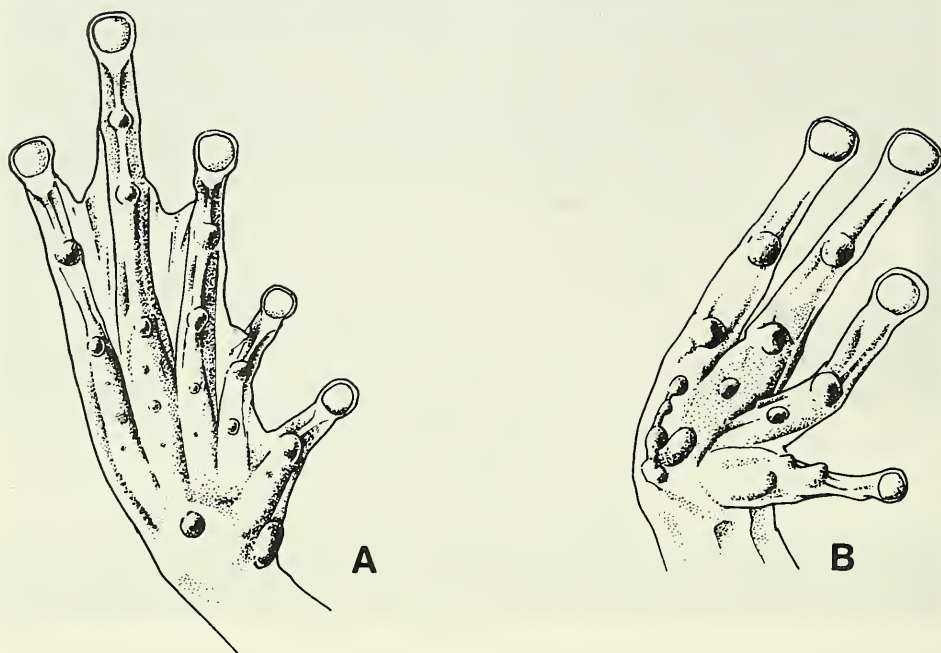


Fig. 3. Undersurfaces of the right pes (Fig. 3A) and right manus (Fig. 3B) of *Litoria littlejohni* sp. nov. (AMS R95802).

order of length,  $5 > 4 = 3 > 2 > 1$ . A small inner metatarsal tubercle and a very small central metatarsal tubercle present.

*Etymology*: The species is named for Dr Murray Littlejohn, of the University of Melbourne, in recognition of his outstanding contributions to anuran biology.

*Diagnosis*: Moderately large brown frog (female S-V 52-68mm; male S-V 40-51mm). Head broader than it is long (HL/HW = 0.91). Distinctive red orange colouration in axillae, around the groin and along the undersurface of the thighs. *L. littlejohni* differs from all other *Litoria* species in its mating call (call duration 7-9 sec, notes/call 7.8-10.7, note duration 250-670 msec, pulse repetition rate 500-700 msec. and dominant frequency 1683-2500 Hz; Table 1).

*Variation*: *L. littlejohni* exhibits marked sexual dimorphism with females usually more than 30% longer than males. Mean S-V of males (N=75) 45.8mm. Mean S-V of females (N=13) 59.1mm. No significant differences were found between male and female specimens for other measurements. The combined means were: TL/S-V = 0.534 (range 0.48-0.58); HLK/HW = 0.910 (range 0.83-0.97); HL/S-V = 0.32 (range 0.30-0.37); HW/S-V = 0.35 (range 0.31-0.37); IN/E-N = 0.91 (range 0.87-0.94); ET = 1.83 (range 1.63-2.11).

*Colour in Life*: Dorsum of body and flanks light brown with a broad dark band (which is indistinct in some specimens) from between the eyes to the cloaca; belly white or cream; anterior and posterior surfaces of the thighs and groin, and the axilla are bright orange red. Iris light golden brown. A dark brown bar occurs from the tip of the snout through the nostrils, on the lateral aspect of the canthus rostralis and of the supratympanic fold to the axilla of the arm.

## KARYOTYPE

Diploid number of chromosomes is 26. All chromosome pairs are biarmed, either metacentric or submetacentric. A secondary constriction, identified as the nucleolar organiser region (NOR) by silver staining, lies subterminally on the long arm of pair 11. A small satellite is terminal to the NOR although it is not always apparent (Fig. 4).



Fig. 4. Karyotype of *Litoria littlejohni* (inset, silver stained NOR on pair 11). Scale bar  $\mu\text{m}$ .

## MATING CALL

Mating call is composed of a series of rapidly repeated notes (6-14). Dominant frequency varies from 1683-1950 Hz (Table 1). The call lasts from 5-12 seconds and sounds like a 'slow, reedy whistle' (Barker & Grigg, 1978; listed as *L. jervisiensis*).

Martin & Littlejohn (1966) listed the physical characteristics of the mating call of *L. littlejohni* (as *Hyla jervisiensis*). The call data presented was recorded at a particularly low temperature (wet bulb  $8^{\circ}\text{C}$ ). Temperature effects on mating call structure have been noted (Littlejohn, 1965), particularly temperature induced changes in frequency. In recording *L. littlejohni* in the Royal National Park, near Sydney (wet bulb  $14^{\circ}\text{C}$ ), the dominant frequency was higher and note duration less (White et al. 1980).

*Litoria littlejohni* calls recorded around Sydney (Darkes Forest and the Royal National Park) are highly distinctive because of a characteristic drop in frequency at the conclusion of each note. This was not found by Martin & Littlejohn (1966) for a specimen from the Cann River, Victoria. The significance of these differences in call structure is not known.

The calling sites used by male *L. littlejohni* vary but are most often on the ground or in very low vegetation. Males have been most frequently observed calling around the edges of temporary muddy pools in forest clearings. They have also been observed calling from bitumen road surfaces and rock piles during very heavy showers.

TABLE 1

*Mating calls parameters of Litoria littlejohni sp. nov.*

Locality	Wet Bulb Air. Temp. (C)	Call Duration (Secs)	Notes/ Call	Note Duration (msec)	Pulse Repetition Rate	Dominant Frequency (HZ)
Royal National Park, N.S.W.	14	6.7	7.8	250	—	1950
Darkes Forest, N.S.W. <sup>a</sup>	—	7.8	8.0	620	—	1800
Cann River, Victoria. <sup>b</sup>	8	9.1	10.7	670	38.5	1683
		6.0-12.3	7.0-14.0	640-700	37.5-39.4	1600-1750

<sup>a</sup> Grigg & Barker (1973)

<sup>b</sup> Martin & Littlejohn (1966)

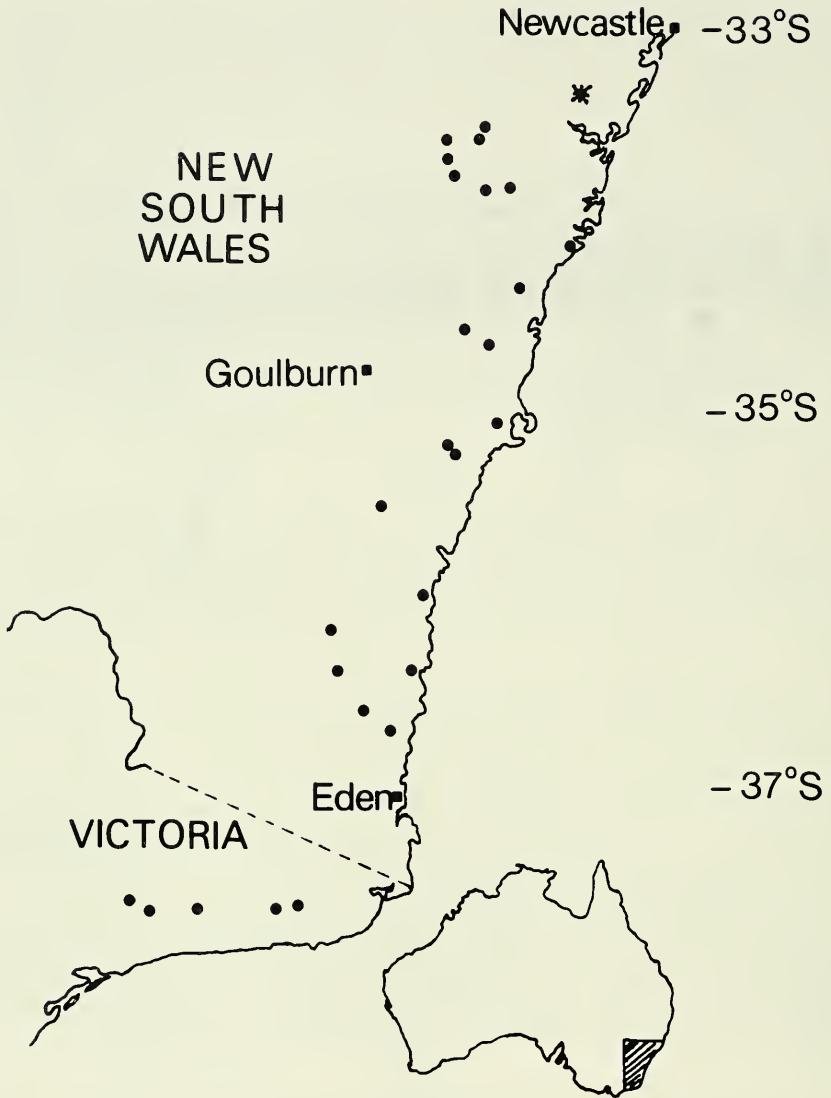


Fig. 5. Distribution of *Litoria littlejohni*. The type locality is indicated by a star, other localities from which specimens have been examined by a closed circle.

#### DISTRIBUTION

*Litoria littlejohni* is confined to eastern New South Wales and Northeastern Victoria (Fig 5), ranging from Watagan State Forest, near Wyong, NSW, to near Buchan, Victoria. Specimens have not been collected further inland than the Blue Mountains (for example, Bell, Blackheath and Mt Wilson). *L. littlejohni* seems to occur on hills or mountains at low altitudes, and the highest elevations from which it has been collected are at the Illawarra escarpment in N.S.W. (850-1,000 m a.s.l.).

## HABITAT

*Litoria littlejohni* is distributed over a wide range of habitats but is not common in any of these habitats. The species occurs in wet and dry sclerophyll forest, coastal woodland and heath. Customarily it is encountered only during heavy rains, particularly in spring and summer. During periods of extensive rain, the species is most often found in temporary pools on the forest floor. It has been most often observed on the ground, occasionally it has found in low shrubs but has not been observed in trees or more than 2 metres above ground level. Shelter sites for the species are unknown.

The common name 'Heath Frog' was applied by White et al. (1980) because of the historical observations of Krefft (1863), Fletcher (1889) and Moore (1961) that the species is often found on ferns or cycads in near-coastal heath. This name is not totally apt as the species has been found in woodland and sclerophyll forest where these understory plants do not occur.

## REPRODUCTIVE BIOLOGY

Martin & Littlejohn (1966) presented detailed information on breeding biology, behaviour and larval development (as *L. jervisiensis*). Calling males were noted in the months of August through to May. Larvae were also collected in August and March.

*L. littlejohni* was observed calling in November 1977 (in the Watagan State Forest, NSW), in December and January 1978 (at Bell, NSW) in January 1979 (at Darkes Forest, NSW), in February 1980 and 1981 (in Royal National Park and Watagan State Forest, NSW). Axillary amplexus was observed in January 1979 (at Bell, NSW) and February 1980 and 1981 (at Royal National Park and Watagan State Forest, NSW).

Oviposition has been noted only in temporary pools and pools filled with run-off water after extensive rainfall. The eggs were attached to floating twigs or branches. Martin & Littlejohn (1966) were unable to find any suggestion of a reduction in larval development despite the very temporary nature of the pools in which the eggs are laid. The type specimen of *L. littlejohni* was collected from a temporary pool in the Watagan State Forest. Some of the frogs were spawning. The pool was also used by mating *Lechriodus fletcheri* (Boulenger), a species with carnivorous tadpoles. Predation between tadpoles was not observed. Recently metamorphosed froglets were found in February 1979 at Tianjara Falls, NSW.

These observations indicate that the species is opportunistic, breeding at most times of the year (except mid-winter) whenever sufficient run-off water is available.

## ACKNOWLEDGEMENTS

We thank Mr Ken Slater of the Canberra College of Advanced Education for his encouragement. We also thank Dr Allen Greer of the Australian Museum, Mr John Coventry of the Museum of Victoria, Mr Glen Ingram of the Queensland Museum, Mr John Wombey C.S.I.R.O. Division of Wildlife, Mr P. Willis of the Macleay Museum, University of Sydney and Mr T. Howkins of the Canberra College of Advanced Education for the loan of the valuable specimens. The drawing of the head, hands and feet of the holotype are the work of Mrs June Jefferies. M. Davies, R. Shine and M. Tyler provided useful comments on the manuscripts.

## References

- BARKER, J., and GRIGG, G. C., 1978. — *A field Guide to Australian Frogs*. Rigby Limited: Sydney.  
 COGGER, H. G., 1992. — *Reptiles and Amphibians of Australia*, 4th Edition. A. H. and A. W. REED, Sydney.  
 DUMÉRIL, A. M. C., and BIBRON, G., 1841. — *Érpetologie Générale ou Histoire Naturelle Complète des Reptiles*. Paris: Roret 8: ii.

- FLETCHER, J. J., 1889. — Observations on the oviposition and habitats of certain Australian batrachians. *Proc. Linn. Soc. N.S.W.* 4: 357-87.
- GOODPASTURE, C., and BLOOM, S. E., 1976. — Visualisations of nucleolar organiser regions in mammalian chromosomes using silver staining. *Chromosoma* 80: 191-217.
- GRIGG, G. C., and BARKER, J., 1973. — *Frog Calls of South-East Australia*. Cassette recording.
- GÜNTHER, A., 1858. — *Catalogue of the Batrachia Salienta in the collection of the British Museum*. London: British Museum.
- KREFFT, G., 1863. — On the batrachians occurring in the neighbourhood of Sydney, with remarks upon their geographic distribution. *Proc. Zool. Soc. Lond.* 1863: 386-90.
- LITTLEJOHN, M. J., 1965. — Premating isolation in the *Hyla ewingi* complex (Anura: Hylidae). *Evolution* 19: 234-43.
- MAHONY, M. J., and ROBINSON, E. S., 1980. — Polyploidy in the Australian Leptodactylid genus *Neobatrachus*. *Chromosoma* 81: 199-212.
- MARTIN, A. A., and LITTLEJOHN, M. J., 1966. — The breeding biology and larval development of *Hyla jervisiensis* (Anura: Hylidae). *Proc. Linn. Soc. N.S.W.* 91: 47-57.
- MOORE, J. A., 1961. — Frogs of eastern New South Wales. *Bull. Amer. Mus. Nat. Hist.* 121: 149-386.
- TYLER, M. J., 1978. — Papuan hylid frogs of the genus *Hyla*. *Zool. Verh.* 96: 1-203.
- WHITE, A. W., WHITFORD, D., and WATSON, G. F., 1980. — Re. Description of the Jervis Bay tree frog *Litoria jervisiensis* (Anura: Hylidae), with notes on the identity of Krefft's frog (*Litoria krefftii*). *Aust. Zool.* 20(3): 375-90.